Goldschmidt 2024 Abstract
https://doi.org/10.46427/gold2024.24382

Insight into engineering performance of chemically stabilized soil through analytical and computational geochemistry.

MR. ASHISH BASTOLA, MS[1], NICHOLAS BENJAMIN PETERSEN[2], PAVAN AKULA[1] AND JOHN RUSHING[3]

[1]Oregon State University
[2]GRI
[3]U.S. Army Corps of Engineers Engineer Research and Development Center

Presenting Author: bastolaa@oregonstate.edu

Chemical stabilization of weak clayey soils is an effective and cost-effective approach for improving engineering properties. Experiment and computational geochemical evaluation of the soil-stabilizer reaction can provide valuable insights into the mineralogical changes driving the improvement in engineering performance. This study investigates the geochemical reactions between calcium-sulfoaluminate cement-based stabilizers, a highly reactive and sustainable stabilizer, and weak clayey soils. Unconfined compressive strength of the samples showed a 200% improvement in strength in 60 minutes. To evaluate the kinetics driving this rapid reaction, X-Ray Diffraction (XRD), Thermogravimetric Analysis (TGA), and Inductively Coupled Plasma Optical Emission Spectroscopy (ICP-OES) of the pore solution extractions at different periods were carried out. Geochemical modeling of the pore solution chemistry indicated ettringite and low-calcium calcium silicate hydrate (C-S-H) as the primary strength enhancing products. XRD and TGA verified the formation of ettringite crystals and calcium-silicate-hydrates (amorphous) as the primary strength-enhancing products. Geochemical modeling of the pore solution chemistry at 14 days after stabilization indicated the potential to precipitate more ettringite and C-S-H. This was validated by the TGA and strength data at 28 days. Thus, this study showed that coupling geochemical modeling and engineering characterization can be a reliable tool for assessment of the improvement in performance of stabilized soil mixtures.